AMERICAN

# RAILROAD JOURNAL,

AND

# MECHANICS' MAGAZINE.

No. 7, Vol. I. Third Series. | JULY, 1843. | Whole No. 426. Vol. XVI.

## DETERIORATION OF WROUGHT IRON AXLES.

Since the Paris railroad accident, much discussion has arisen as to the character of iron and mode of manufacture of axles. It is contended that those axles which have broken apparently from a flaw in the iron, have in reality become changed throughout their mass—that the fibrous structure of wrought iron is changed in course of time into a cristalline and brittle grain—and that these changes occur in the best made axles, and in the best quality of iron, and that they are produced by long continued use.

How far these assertions are correct it is difficult to say, the interest of manufacturers is to shorten as much as possible the period during which an axle can be worked with safety; on the other hand it is probable that the consumers are willing to believe that the longest possible period that can be named is more near the truth. Some of the statements made in foreign Journals are evidently influenced in the manner first named. Still we should be cautious about denying that any change of this kind does take place, as it is well known that a similar gradual passage to the cristalline structure is known to take place in other metals and in alloys. It is not unlikely that the vibration throughout the iron, caused by the constant jar of passing over the rails, may produce this change with rapidity.

A writer in the Civil Engineer and Architects Journal gave in confirmation of this theory the statements of a French manufacturer of great experience. This gentleman has arrived at the conclusion that an axle can only safely run about 75,000 miles; after that time it is his constant practice to take it out, place it between two new bars of iron, and weld the whole together into a new axle. He also states that when paved roads are passed over, the distance run is not so great to produce the same effects, and that according to his experience the wear of the collar is a direct measure of the length of time during which the axles may be considered safe.

From the statements which may at least be considered as not far from the truth, we may infer that the character of the road will greatly influence the duration of the axles—that a firm, hard and unyielding structure will cause

their more rapid deterioration, while a more elastic road, if well laid and constantly kept in repair, may allow of their use for an indefinite period. It is to this cause that we attribute the want of coincidence of the experience of this country and that of Europe. That a time will arrive, beyond which it will not be safe to use an axle, no matter how favorable the structure of the road, there can be no doubt—the only question is, what this time may be. The experience of many years will probably be required to determine the question.

The want of precise information upon this point, need not, however, deter us from attempting to prevent or retard such changes in iron. The manner in which this may be accomplished can only be ascertained by experiment, yet useful suggestions may be made derived from correct reasoning upon well ascertained facts, or from the small amount of experience now in our possession. The most simple suggestion which has been made is this. The same alteration takes place under the influence of heat improperly applied, it is therefore a question whether the electricity or magnetism developed by friction may not be in some measure the agent in producing a cristalline structure. It is proposed, therefore, to reverse the motion of the axle so as to prevent this action, or rather that the effects produced by motion in one direction may be neutralized by motion in the other direction.

Another proposal which we have to make, is that the axle should be loaded with pieces of iron or lead fastened upon it at one or more points, and that the position of these should be from time to time changed; by this means the direction and force of the vibrations will never be the same for any great length of time, and the cristalline texture may thus be prevented from assuming that regularity of grain which renders the mass brittle.

Since writing the above, we have obtained a copy of the paper of Mr. Charles Hood upon this subject, which seems so much to the purpose that we insert the whole of it.

CHANGES INDUCED IN THE STRUCTURE OF IRON SUBSEQUENT TO MANUFACTURE.—BY CHARLES HOOD, ESQ., F.R.A.S.

The important purposes to which iron is applied have always rendered it a subject of peculiar interest; and at no period has its importance been so general and extensive as at the present time, when its application is almost daily extending, and there is scarcely anything connected with the arts, to which, either directly or indirectly, it does not in some degree contribute. My object in the present paper is to point out some peculiarities in the habitudes of iron which appear almost wholly to have escaped the attention of scientific men; and which although in some degree known to practical mechanics, have been generally considered by them as isolated facts, and not regarded as the results of a general and important law. The circumstances, however, well deserve the serious attention of scientific men, on account of the very important consequences to which they lead. The two great distinctions which exist in malleable wrought iron, are known by the names of "red-short" and "cold-short" qualities. The former of these comprises the tough fibrous iron, which generally possesses considerable strength when cold; the latter shows a bright crystallized fracture, and is very brit-

tle when cold, but works ductile while hot. These distinctions are perfectly well known to all those who are conversant with the qualities of iron; but it is not generally known that there are several ways by which the tough red-short iron becomes rapidly converted into the crystallized, and by this change its strength is diminished to a very great extent.

The importance which attaches to this subject at the present time, will not I think, be denied. The recent accident on the Paris and Versailles railway, by which such a lamentable sacrifice of human life has occurred, arose from the breaking of the axle of a locomotive engine, and which axle presented at the fractured parts the appearance of the large crystals, which always indicate cold-short and brittle iron. I believe there is no doubt however, that this axle, although presenting such decided evidence of being at the time of this accident of the brittle cold-short quality, was at no distant period tough and fibrous in the highest degree. I propose, therefore, to show how these extraordinary and most important changes occur, and shall point out some at least of the modes by which we can demonstrate the truth of this assertion by actual experiment.

The principal causes which produce this change are percussion, heat, and magnetism; and it is doubtful whether either of these means *per se* will produce this effect; and there appear strong reasons for supposing that, generally, they are all in some degree concerned in the production of the observed results.

The most common exemplification of the effect of heat in crystallizing fibrous iron, is by breaking a wrought iron furnace bar, which, whatever quality it was in the first instance, will, in a short time, invariably be converted into crystallized iron; and by heating, and rapidly cooling, by quenching with water a few times, any piece of wrought iron, the same effect may be far more speedily produced.

In these cases we have at least two of the above causes in operation—heat and magnetism. In every instance of heating iron to a very high temperature, it undergoes a change in its electric or magnetic condition; for, at very high temperatures, iron entirely loses its magnetic powers, which return as it gradually cools to a lower temperature. In the case of quenching the heated iron with water, we have a still more decisive assistance from the electric and magnetic forces; for Sir Humphry Davy long since pointed out (Chem. Phil., p. 138) that all cases of vaporization produced negative electricity in the bodies in contact with the vapor—a fact which has lately excited a good deal of attention, in consequence of the discovery of large quantities of negative electricity in effluent steam.

These results, however, are practically of but little consequence; but the effects of percussion are at once various, extensive, and of high importance. We shall trace these effects under several different circumstances.

In the manufacture of some descriptions of hammered iron, the bar is first rolled into shape, and then one-half the length of the bar is heated in a furnace, and immediately taken to the tilt-hammer and hammered; and the other end of the bar is heated and hammered in the same manner. In order to avoid any unevenness in the bar, or any difference in its color, where the two distinct operations have terminated, the workman frequently gives the bar a few blows with the hammer on that part which he first operated upon. That part of the bar has, however, by this time become comparatively cold; and if this cooling process has proceeded too far when it receives this additional hammering, that part of the bar *immediately* becomes crystallized, and so extremely brittle that it will break to pieces by merely throwing it on the ground, through all the rest of the bar will exhibit the best and

toughest quality imaginable. This change, therefore, has been produced by percussion (as the primary agent,) when the bar is at a lower temperature than a welding heat.

We hear see the effects of percussion in a very instructive form. And it must be observed that it is not the excess of hammering which produces the effect, but the absence of a sufficient degree of heat at the time the hammering takes place; and the evil may probably be all produced by four or five blows of the hammer, if the bar happens to be of a small size. In this case we witness the combined effects of percussion, heat, and magnetism. When the bar is hammered at the proper temperature, no such crystallization takes place, because the bar is insensible to magnetism. But as soon as the bar becomes of that lower degree of temperature at which it can be affected by magnetism, the effect of the blows it receives is to produce magnetic induction; and that magnetic induction and consequent polarity of its particles, when assisted by further vibrations from additional percussion, produces a crystallized texture. For it is perfectly well known that in soft iron, magnetism can be almost instantaneously produced by percussion; and it is probable that the higher the temperature of the bar at the time it receives the magnetism, the more likely will it be to allow of that re-arrangement of its molecules which would constitute the crystallization of the iron.

It is not difficult to produce the same effects by repeated blows from a hand-hammer on small bars of iron; but it appears to depend upon something peculiar in the blow, which, to produce the effect, must occasion a complete vibration among the particles in the neighborhood of the part which is struck. And it is remarkable that the effects of the blows in all cases seem to be confined within certain limited distances of the spot which receives the strokes. Mr. Charles Manby has mentioned to me a circumstance which fully bears out this statement. In the machine used for blowing air at the Beaufort iron works, the piston rod of the blowing cylinder, for a considerable time, had a very disagreeable jar in its motion, the cause of which could not be discovered. At last the piston rod broke off quite short, and close to the piston; and it was then discovered that the key had not properly fastened the piston and rod together. The rod, at the fracture, presented a very crystallized texture; and as it was known to have been made from the very best iron, it excited considerable surprise. The rod was then cut at a short distance from the fracture, and it was found to be tough and fibrous in a very high degree—showing what I have already pointed out, that the effects of percussion generally extend only a very short distance. In fact, we might naturally expect, that as the effect of vibration diminishes in proportion to the distance from the stroke which produces it, so the crystallization, if produced by this means, would also diminish in the same proportion. The effect of magnetism alone may also be estimated from this circumstance. The rod would of course be magnetic throughout its whole length, this being a necessary consequence of its position, independent of other circumstances; but the necessary force of vibration among its particles only extended for a short distance, and to that extent only did the crystallization proceed. The effect of magnetism in assisting the crystallization, I think it unnecessary to dwell upon, as the extensive use of galvanic currents in modern times has fully proved their power in crystallizing some of the most refractory substances; but by themselves they are unable to produce these effects on iron, or at least the operation must be extremely slow.

Another circumstance which occurred under Mr. Manby's observation, confirms generally the preceding opinions. A small bar of good tough iron

was suspended and struck continuously with small hand hammers, to keep up a constant vibration. The bar, after the experiment had been continued for some considerable time, became so extremely brittle, that it entirely fell to pieces under the light blows of the hand hammers, presenting throughout its structure a highly crystallized appearance.

The fracture of the axles of road vehicles of all kinds is another instance of the same hind. I have at different times examined many broken axles of common road vehicles, and I never met with one which did not present a crystallized fracture; while it is almost certain that this could not have been the original character of the iron, as they have frequently been used for years with much heavier loads, and at last have broken, without any apparent cause, with lighter burdens and less strain than they have formerly borne. The effects, however, on the axles of road vehicles are generally extremely slow, arising, I apprehend, from the fact that, although they receive a great amount of vibration, they possess a very small amount of magnetism, and are not subject to a high temperature. The degree of magnetism they receive must be extremely small, from their position and constant change with regard to the magnetic meridian, the absence of rotation, and their insulation by the wood spokes of the wheels. Whether the effects are equally slow with iron wheels used on common roads, may perhaps admit of some question. With railway axles, however, the case is very different. In every instance of a fractured railway axle, the iron has presented the same crystallized appearance; but this effect, I think, we shall find is likely to be produced far more rapidly than we might at first expect, as these axles are subject to other influences, which, if the theory here stated be correct, must greatly diminish the time required to produce the change in some other cases. Unlike other axles, those used on railways rotate with the wheels, and consequently must become, during rotation, highly magnetic. Messrs. Barlow and Christie were the first to demonstrate the magnetism, by rotation, produced in iron; which was afterwards extended by Messrs. Herschel and Babbage to other metals generally, in verifying some experiments by M. Arago. It cannot, I think, be doubted that all railway axles become from this cause, highly magnetic during the time they are in motion, though they may not retain the magnetism permanently. But in the axles of locomotive engines, we have yet another cause which may tend to increase the effect. The vaporization of water, and the effluence of steam, have already been stated to produce large quantities of negative electricity in the bodies in contact with the vapor; and Dr. Ure has shown (Jour. of Science, vol. v. p. 106) that negative electricity, in all ordinary cases of crystallization, instantly determines the crystalline arrangement. This, of course, must affect a body of iron in a different degree to that of ordinary cases of crystallization; but still we see that the effects of these various causes all tend in one direction, producing a more rapid change in the internal structure of the iron of the axle of a locomotive engine than occurs in almost any other case.

Dr. Wollaston first pointed out that the forms in which native iron is disposed to break are those of the regular octahedron and tetrahedron, or rhomboid, consisting of these forms combined. The tough and fibrous character of wrought iron is entirely produced by art; and we see in these changes that have been described an effort at returning to the natural and primal form—the crystalline structure, in fact, being the natural state of a large number of the metals; and Sir Humphry Davy has shown that all those which are fusible by ordinary means assume the form of regular crystals by slow cooling.

The general conclusion to which these remards lead us, appears, I think,

to leave no doubt that there is a constant tendency in wrought iron, under certain circumstances, to return to the crystallized state; but that this crystallization is not necessarily dependent upon time for its development, but is determined solely by other circumstances, of which the principal is undoubtedly vibration. Heat, within certain limits, though greatly assisting the rapidity of the change, is certainly not essential to it; but magnetism, induced either by percussion or otherwise, is an essential accompaniment of the phenomena attending the change.

At a recent sitting of the Academy of Sciences at Paris, M. Bosquillon made some remarks relative to the cause of the breaking of the axle on the Versailles railroad; and he appears to consider that this crystallization was the joint effect of time and vibration, or rather, that this change only occurs after a certain period of time. From what has here been said, it will be apparent that a fixed duration of time is not an essential element in the operation: that the change, under certain circumstances, may take place instantaneously; and that an axle may become crystallized in an extremely short period of time, provided that vibrations of sufficient force and magnitude be communicated to it. This circumstance would point out the necessity for preventing as much as possible all jar and percussion on railway axles. No doubt, one of the great faults of both engines and carriages of every description, but particularly the latter, is their possessing far too much rigidity; thus increasing the force of every blow produced by the numerous causes incidental to railway transit, by causing the whole weight of the entire body in motion to act by its momentum, in consequence of the perfect rigidity of the several parts, and the manner of their connection with each other, instead of such a degree of elasticity as would render the different parts nearly independent of one another in the case of sudden jerks or blows; and which rigidity must produce very great mischief both to the road and to the machinery moving upon it. The looseness of the axles in their brasses must also be another cause which would greatly increase this evil.

Although I have more particularly alluded to the change in the internal structure of iron with reference to the effects on railway axles, it need scarcely be observed that the same remarks would apply to a vast number of other cases, where iron, from being more or less exposed to similar causes of action, must be similarly acted upon. The case of railway axles appears to be of peculiar and pressing importance, well deserving the most serious consideration of scientific men, and particularly deserving the attention of those connected with railways, or otherwise engaged in the manufacture of railway machinery, who have the means of testing the accuracy of the theory here proposed; for if the views I have stated be found to harmonize with the deductions of science, and to coincide with the results of experience, they may have a very important effect upon public safety. It may be observed on the other hand, however, that at the present time all railway axles are made infinitely stronger than would be necessary for resisting any force they would have to sustain in producing fracture, provided the iron were of the best quality; and to this circumstance may perhaps be attributed the comparative freedom from serious accidents by broken axles. The necessity for resisting flexure and the effects of torsion, are reasons why railway axles never can be made of such dimensions only as would resist simple fracture; but it would be very desirable to possess some accurate experiments on the strength of wrought iron in different stages of its crystallization, as there can be no doubt that very great differences exist in this respect; and it is probable that in most cases, when the crystallization has once commenced, the continuance of the same causes which first produced it goes on continu-

ally increasing it, and thereby further reduces the cohesive strength of the iron.

---

PROFESSIONAL EMPLOYMENT.

There are several very common misapprehensions in regard to Civil Engineers which we conceive to be the cause of much loss, to the profession of employment, and to the public of valuable services, obtainable at not greater cost than the less valuable substitute commonly resorted to. It is of the highest consequence to the profession that these errors should be corrected fully and promptly.

The public estimate of the proper sphere of engineering duty, is limited to the construction of railroads, canals, and sometimes, bridges. The construction, as well as the laying out of common roads, the building of piers, wharves, sea-walls, etc., of the large majority of bridges, of large edifices whose strength depends entirely on the disposition of material—all these, and many other labors belonging properly and exclusively to the profession of civil engineering, are almost universally assigned to those who should not be permitted to venture beyond the mechanical duties of construction under some competent superintendance.

In bridges, and other large structures, it is customary to employ no other engineer than the builder, constructor or contractor himself. The impropriety of this proceeding would, we should think, be so manifest that no one consulting his own interest would attempt it. That the same person should, both plan the work and construct it, and thus become a judge of his own performance is a most unusual mode of doing business.

The popular mistakes upon this point, have arisen from the constant demand for engineers upon our railroads and canals having until recently allowed no opportunity for their employment upon other works—even if it had been desired. We should not think there could be any doubt as to the capacity of a properly instructed engineer. The nature of his profession is such that he is compelled to pay attention to many and diverse modes of construction, and to the general applications of physical science. In fact the education of a civil engineer embraces the full consideration of all the arts of construction, and he is therefore a better projector of building than either a carpenter or a mason.

The unfrequent employment of our own civil engineers in other than works of public improvement, has in a measure arisen from the vast numbers of needy adventurers from abroad who have hitherto forced themselves into all situations of this kind. Men unknown at home, have pretended to instruct the whole profession in this country—and in several instances it has been shown that these very men have never been previously employed in any other than subordinate situations, such as do not even require any acquaintance with the profession of those by whom they are employed.

The results of this practice have been doubly disadvantageous, by exclu-

ding our own engineers from employment, and also by throwing discredit upon the very name of civil engineer.

At the present time when but few railroads or canals are in process of construction, a large number of well informed and capable civil engineers are without anything to do. The resort to such men for advice, would not only be employment to them, but profit to those consulting. This subject is deserving of consideration by all parties. If much skill and intelligence now remains unemployed and may by any arrangement be brought into use, this certainly would be a public benefit, as well as an individual accomodation.

---

PRACTICAL REMARKS ON BLAST FURNACES.—BY GEO. THOMSON, ESQ., MINING ENGINEER.

[Read before the Glasgow Philosophical Society, 4th January, 1843.]

There is a manifest absence of anything like correct principle in iron smelting; and although the reduction of ore by cementation may be an easily explained operation, yet, the peculiar combinations brought to bear in the blast furnace, seem to present a problem which chemical science is as yet unable to explain.

In the attempted solutions of the problem, a too limited number of facts have been generally considered, and generalizations attempted, from facts bearing partially on unvaried conditions. Following the system of induction, if a true principle is only to be attained through the medium of facts in every variety and under every possible condition, the object may be assisted, in some measure, by my laying before the society a few facts which have come under my own observation, and may be peculiar. The results given are divided into three principal conditions; viz., 1st, as respects the direct influence, *cæteris paribus*, of different material. 2d, influence of shape and size. 3d, influence of blast, as to diffusion, pressure, or quantity.

1st, *Influence of material.*—Although *all* the materials used in smelting have a certain influence; it is the coal which gives the most extraordinary results as respects "yield." A few results of various coals are therefore collected into the following table from my own immediate observation. The word "yield," is used to denote the comparative quantity of coals used in the furnace, to produce, or to smelt a ton of iron. In the table, the weekly quantity of iron given, as produced by hot blast, is small in comparison with what is now made at most furnaces; yet these are the more correct *comparative* results, having been attained with like conditions of size shape, number of tweres, etc. Since that time, the shape and size of furnaces have been materially altered, as well as other conditions, and the make greatly increased.

Referring to the table, the first three coals are found in the same coal-field and at no very great depth from each other. The cold blast results of these came directly under my own observation, and are taken from several years' work; the hot blast results are from a neighboring work, and subject to similar conditions in almost every respect. Here, then, in the same coal-field are three different coals, which, when under similar conditions with cold blast, give very different results; so much so, as to have taken nearly twice as much of one kind of coal to make a ton of iron as of another (yard coal 6½ tons, clod coal 3 tons;) but when the hot blast is applied, we find they are very nearly assimilated, so that, upon the coal which works *best* with cold blast, that application has scarcely any effect, while on the inferior coal it has a most surprising one.

## TABLE No. I.

| PLACES. | COALS. | | | RESULTS. | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | COLD BLAST. | | HOT BLAST. | | |
| | No. | Local name. | Loss in Coking. | Coal to a ton of iron in furnace. | Weekly produce from 1 furnace. | "Raw," or Coked. | Coal to a ton of iron in furnace. | Weekly produce from 1 furnace. |
| SHROPSHIRE, (Lightmoor Works,) . . . . | 1 | Clod Coal, | 45 per cent. | 3 Tons. | 70 Tons. | Coked. | 2½ Tons. | 80 Tons. |
| | 2 | Yard Coal, | 50 — | 5 to 5½ | 40 | Coked. | 2½ to 3 | 80 — |
| | 3 | Little Flint Coal, | 50 — | 4 | 50 to 60 | Coked. | 2½ to 3 | 80 — |
| | | Do. | Uncoked. | 2½ to 3 | 50 to 60 | | | |
| SOUTH STAFFORDSHIRE, (Wedensbury Work,) . | 4 | Thick Coal, | 45 per cent. | 3 | 60 | Raw. | 2½ | 80 — |
| | 5 | Tipton Coal, | 45 — | 5½ | 35 | Raw. | 2½ | 60 — |
| NORTH STAFFORDSHIRE, (Fenton Park,) . . | 6 | Ash Coal, | 50 — | 5½ | 35 | ½ Coke, ½ Raw. | 3½ | 45 — |
| | 7 | Rider Coal, | 55 — | 7½ | 25 | Coked. | 4¼ | 40 — |

DESCRIPTION OF COALS.

No. 1 is soft, stratified, and dull; horizontal sections filled with carbonaceous matter; burns with a white ash; produces a soft coke, which retains carbonaceous matter in divisions.

No. 2. Rather hard, cubical and bright; calcareous matter in transverse divisions; burns to a brown ash; produces a hard coke, and is considered very sulphury.

No. 3. Hard, cubical, shining; burns to a white ash; produces a very hard coke.

No. 4, is of various stratifications, differing in character; is generally known.

No. 5. Schistous, very friable, with carbonaceous matter between horizontal layers.

No. 6. Bright, conchoidal, free burning, and renders a white ash; is preferred for burning the china and "pottery ware" of the district.

No. 7. Bright, conchoidal, burns very hot, leaves a brown ash. A stratum of pyrites lies directly below it in the coal field, of about six inches in thickness.

The two next coals in the table from the Wolverhampton coal field, show a similar result. The sixth and seventh, or the last two coals of table No. 1, belong to North Staffordshire—the district of the "Potteries." There my results are also given from a direct personal observation of several years; and I do not think I err in saying, that the materials of this district, taking

coal and ironstone together, are the worst in the kingdom for iron smelting. The coals given are compared under precisely similar conditions both with cold and hot blast, and although obtained from the working of a very small furnace, (only 32 feet high,) the *comparative* results will not be affected thereby. They lie very close to each other, being merely separated by a stratum of shale a few feet in thickness, often less, and, consequently, show how great a difference occurs, not only in different districts, but within a few yards, vertically, of the same field.

With modifications of the shape, and increase of size, (to which we shall attend more particularly under that head,) we were ultimately able to work No. 6, ash coal, in the furnace, without coking, and at a consumption of only 2½ tons to the ton of iron, with a make of upwards of 70 tons a week; but No. 7, rider coal, although these conditions altered the make considerably, and the yield slightly, we were never able to work *without* coking; again and again we tried to do so by commencing with a small quantity, and gradually increasing it, but in vain; every increase of this coal to the burden, without coking, was followed by a decrease of yield, make, and quality.

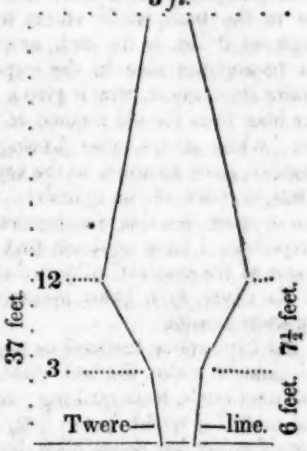
As regards ironstone, the effects of different qualities are not so striking as those of coal, with respect to *yield*, but they have a great influence on the *quality* of the iron produced. For instance, that which is known as the Shropshire pennystone—a peculiar kind of argillaceous ironstone found in small nodules imbedded in a stratum of indurated clay—and containing about 30 to 35 per cent. of iron, is supposed to give the peculiar strength and toughness to the Shropshire pig iron. When another ironstone, (siliceous) locally termed "crawstone," which is found partially stratified in a bed of sandstone rock, is mixed with the pennystone, even in proportion of 1 to 10, the effect is very observable in making the iron much more fluid, altho' it retains its stoutness. Again the effect of the "red ore" of Cumberland, or peroxide of iron, mixed with argillaceous, or other ironstone, is well known; it adds in every case very materially to the strength of the iron, and the effect is especially so with the hot blast. Forge cinder, which is a protoxide of iron, mixed with silecious, or other foreign matter, has a directly contrary effect both with cold and hot blast,—so much so, indeed, that I have seen hot blast iron which had been made with a large proportion of "cinder," so weak as to break into several pieces when dropped on the ground from the height of a couple of feet. I may here remark, that it is not surprising that we should hear so many conflicting opinions on the *strength* of hot blast pigs, by those who only quote results without considering the conditions which affect them.

These results on the quality of iron by the use of different kinds of ironstone are very general, but such effects are well know, and are constant; and when we consider that there is only one kind of iron, in fact, surely it is worthy the attention of the scientific to inquire whence arise such differences, and how they should be produced by a simple mixture of "red ore," or of "forge cinder."

2d, *Influence of shape and size.*—We now come to a few results connected with the shape of furnaces; and on this point there seems to be at different times a ruling fashion. At the time of making the experiment to which I shall first refer, which was before the hot blast had been brought into notice, the prevailing fashion in England was to make the furnaces as narrow as possible, both at the "neck," or filling place, and at the "hearth." The furnace on which the experiment was made was at Lightmoor, in Shrop-

shire, the shape and size of which is represented in fig. No. 1. It worked worse than any of the others with the same coal, which was a mixture of those already referred to in table I; and the only difference of its shape, compared with the others, is in being about 6 to 9 inches wider at the boshes, and three feet less in height.

*Fig.* 1.




This furnace consumed about 5 tons of coals in producing a ton of iron, and made only about 40 tons per week. The alteration made upon it was very simple to appearance, consisting only of widening the top from 3 feet, to 5 feet diameter, and carrying that width perpendicularly up 6 feet higher; also placing two filling holes, one on each side, over tweers, instead of one in the middle, merely, as it were, placing a cylinder of 5½ feet diameter and 6 feet high upon the top.

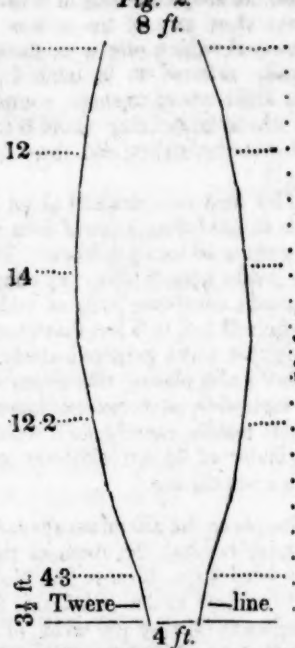
Simple as the alteration appears, however, it was followed by very extraordinary results; the moment the charge arrived at the bottom, the iron from hard forge, became fine No. 1. The burden was accordingly increased from time to time, until this furnace with the same material and same blast, made 60 tons per week of good forge pigs, with a consumption of only 3½ tons of coal to a ton of iron. The result is not attributable to the widening and double filling holes alone; for the effect was repeatedly tried by filling holes at the original height directly under the upper ones, and in every case we had to take burden off to make an equal quality, thereby reducing both the quantity and the yield.

Mr. Gibbons, of Corbyns Hall furnaces, near Dudley, has arrived at very striking results with cold blast, by alteration of shape and increase of size. He states in his publication on the subject, that he was led to the idea by observing the well known fact, that furnaces, especially cold blast ones, scarcely ever come into full work until six months after they have been blown in; and also, that every year, so long as the "boshing" of the furnace is not wholly gone, they improve their work both in yield and in quantity; further, in observing that furnaces, when blown out, although they had not been working for more than six or eight months, were materially altered from their original shape. By studying the natural shape, as it might be termed, he has arrived at an improved form.

This improved furnace (fig. 2.) has more than double the capacity of his original one, the dimensions of which were 8 feet wide on the hearth, 3½ feet at the boshes, 12 feet at the belly, and 4 feet at the top. The height from the hearth to the boshes 6 feet, from the boshes to the belly 8 feet, total height, 45 feet; and the larger content is in the upper half—the top is 8 feet diameter, and there are four filling holes. The greatest produce of his original furnace he states to have been 74 tons per week, while that of the improved one has reached 115 tons in one week. This is by cold blast, with a density of only 1 lb. 13 oz. per inch at the twere.

Mr. Gibbons' opinion, like that of many others, is, that with the hot blast the shape or the size has very little effect; but that this is not the case is now well known.

*Fig. 2.*




3d, *Influence of Blast.*—In cold blast working, some practical men hold that the density of the blast should not exceed 2 lbs. to the inch, while others work it as high as 3 lbs. to the inch, or even more. In re-smelting also in the cupola, many prefer the fanners, which give a much *softer* blast than the old method of the cylinder; while others, after having tried the fanners, have returned to the original and stronger blast of the cylinder. We cannot suppose that this is altogether fancy or prejudice; I have no doubt that the differences of the material subjected to the blast is the cause, in a great measure, of such opposite results.

At Lightmoor, the various requirements of blast to make the best yield, with the different coals, were striking; coal No. 1, (of table I.,) which is the best, required a considerably less dense blast than the inferior, No. 2, (coal yard.) Indeed, blast, either in volume or pressure, seemed to be of little consequence to the working of the clod coal, from 1¾ lbs. to 2¾ lbs. to the inch, the yield was not affected, the only difference being a slight increase of quantity. Nor did diffusing the blast by a number of tweres seem to make a material difference. It is a fact that with this coal, and a furnace of ordinary dimensions, 60 tons of iron have been made in a week by one blast pipe only, the muzzle only 3 inches diameter, or 9 circular inches of blast.

On the other hand, the inferior, or, as they are called there, the "sulphury" coals, required a highly compressed blast to bring them to their best yield—one under 2½ lbs. to the inch gave very inferior results; compare this with Mr. Gibbons' result, his materials seem well adapted for cold blast working, and we find density of blast not a great object to them. 1 lb. 13 oz. only was his density at tweres, and this continued the same although he doubled the capacity of his furnace.

[To be continued.]

---

RAILROAD ITEMS.

*Utica and Schenectady railroad.*—The old board of Directors are re-elected. Erastus Corning, President.

*Meeting of stockholders of Norwich and Worcester railroad.*—The annual meeting of the stockholders of this road took place in this city yesterday. The meeting was large and the action upon the various subjects which came up harmonious. The treasurer's report shows a very decided and important improvement in the affairs of the company since the last annual meeting. The most important question acted upon was that of the extension of the road down the river to a point near the sound. By an almost perfectly unanimous vote, it was resolved thus to extend the road, and we presume the work will be commenced forthwith. The precise point to which the extension shall be made, is not yet fixed upon, the matter having been referred to a committee to examine and report hereafter.

Daniel Tyler was re-elected president.—*Norwich Courier.*

The following gentlemen were on Monday unanimously elected directors of the New Jersey railroad and transportation company for the ensuing year:—J. S. Darcy, Adam Lee, Stephen Whitney, John P. Jackson, John Acken, J. Phillips Phœnix, D. S. Gregory, Wm. S. Johnson, Abraham G. Thompson.—*N. Y. American.*

*The United States steamer Union.*—The Courier and Enquirer of June 3d says: "This new national steamer, on the plan of Lieut. Hunter, arrived in our harbor on Thursday, and, we are proud to say, has completely demonstrated the feasibility and superiority of this invention over all others. We were among those who doubted its success; and yet we feel assured that there is no individual in the country who more sincerely rejoices than we do in this practical triumph of Mr. Hunter in securing to his country and to the world a steam vessel which, at all times and under all circumstances, may be exposed to an enemy's fire without danger to her wheels. We are pleased to hear that Mr. Hunter is quite sanguine of very greatly increasing the speed of the next vessel to be built upon the same plan."

*Charles L. Schlatter, Esq.*, Chief Engineer of the public works of Pennsylvania, has resigned, having received an appointment from the war department, which will station him at Chicago.

---

### HARTFORD AND SPRINGFIELD RAILROAD.

This long talked of railroad, is, we have evidence to believe, soon to be completed. It *ought* to have been done at an earlier date. Its completion will make the *fourth* railroad from the waters of Long Island Sound, connecting with that great *main artery*—the Western railroad from Boston, which is to be like the *trunk* of a vast tree, with branches putting out in every direction, reaching into every northern and western State in the Union, yet like the branches of a tree all pointing to a common centre, which is BOSTON; and, like the tree whose sap descends in the autumn through the trunk to the roots, and ascends again on the return of mild breezes in the spring to the branches, so will flow a vast amount of business to and from that enterprizing and calculating city, which has hitherto, and would always have come to New York, if her capitalists, her business men, and her *politicians* had possessed a tithe of the public spirit and far reaching sagacity which has characterized the course of the Bostonians. Boston has never, like New York, made herself ridiculous by opposing every, or any public work which in the remotest degree would add to her business, or increase her wealth and population; but on the contrary, her citizens have been always ready both individually and collectively, to encourage and aid those in other places who were willing to risk their capital in the construction of public works *pointing towards* Boston; having the sagacity to see that no work of the kind could be put into operation without benefiting their own city. But how has it been, nay, how is it even *now* with New York? Have her citizens, with their immense wealth, with nearly as many *houses* and *ships* and *steamboats*, as Boston has inhabitants, given even a listening ear to those who for many years have labored and struggled to open an easy, direct, and *always* available communication with the interior; and sustained the few who at an early day projected the two noblest avenues that

could be constructed from her busy streets *north and westward*, to connect with the canals, (or, as her once leading citizens denominated them "*Clinton's big ditches*,") and with the vast lakes of the west? Never. A few, only of her intelligent and wealthy citizens have ever given these important works the benefit of their counsels and the aid of their means, and even many of these became disheartened, after having made a noble effort deserving a better result, and gave up in disgust at the appathy, the folly, or the short-sightedness of their fellow citizens; hence it is, that with a population of nearly 350,000, she can only *boast!* of a *single* railroad, built by her citizens, and terminating in her streets, of the *astonishing* length of—not like Boston with a connection or web of railroads of *twelve hundred* miles, but of—*about twelve* miles!!!

'Tis true her citizens have aided in constructing a number of railroads besides the Harlem road; there is the Paterson road of 14 miles, the Schenectady and Saratoga road a little longer than either of the others named, and the Stonington road, and the Long Island road, making a total of about *one hundred and sixty miles*, and perhaps they have aided in the construction of others at a distance some of which have not been completed, and where there was no possibility of immediate benefit to this city when completed, unless the city is benefitted by the game of shuttle-cock, so much played in Wall street with railroad stocks by a class of gentlemen who apparently grow rich by the game rather than by the produce of the roads.

Had sound policy and good judgment directed the expenditure of the capital invested by our citizens in railroads of comparative insignificance, we should now have the benefit of two main lines of railroad north and west from this city, reaching the Canadas and the great lakes, which would eventually have their numerous branches penetrating almost every county in the State, and other States, through which New York merchants and cartmen and owners of real estate would derive a large portion of the benefits of an immense business which will now find an outlet at Boston, and to which her citizens are richly entitled by their sagacity and public spirit.

The city of New York has been playing shuttle-cock with *fancy* stocks and politics, while Boston has labored at the *oar* and the *anvil* until she has spread herself all over the country, or brought the distant country to her very doors by means of her iron ways.

---

### LOW FARES ON RAILWAYS.

The directors of the Boston and Providence railroad, have passed a vote to reduce the price of fare on the road on the 17th, one-third from the usual rate. The present price of fare from Boston to providence, 41 miles, is $1 50. Reduced one-third, it will be $1; or two and a half cents per mile. This rate per mile, may, we think, be safely assumed as the rate which will yield the largest revenue to railways in this country. If adopted on the railways from Troy to buffalo, it would reduce the price of a passage between the two cities to about $7 50; which is indeed, the price now paid in the second class train, in which passengers are transported like cattle in long low boxes, with here and there an aperture to admit light and air, but no glass windows

to admit light and exclude air, when necessary. Should the several railway companies which control the railways from Schenectady to Buffalo, put these roads in first rate order, introduce the elegant and commodious cars used on the Schenectady and Troy, and on every other well managed railway, and reduce the fare in such cars or two and a half cents per mile; starting from every stopping place with the punctuality of a chronometer, * * * they would find their "account in it" at the end of the year. The travelling public would be far better accommodated than it ever has been between Buffalo and schenectady, and the proprietors of the roads receive larger dividends than they have ever received. At any rate, it is worth while for them to try the experiment. * * * If railways are to be allowed a certain monopoly, they certainly ought to be compelled to accommodate travellers in the *best* manner, and at moderate prices.

"Truth is mighty, and will prevail," and so will the system of "low fares" prevail, as the recent course of the Boston and Providence railroad company (an account of which we find in the Troy Whig,) indicates. *One dollar* from Boston to Providence will be found a fair rate, and $7,50 or $8 from the Hudson to lake Erie, should insure good accommodations, good attention, and punctuality in departure and arrival. Railroads are designed as much for the accommodation and comfort of travellers, as for the benefit of capitalists and stockholders, and the increase of the former will be surely found to promote the interests of the latter.

## RAILROADS IN ILLINOIS.

A correspondent of the Cincinnati Gazette, travelling in Illinois, describes the only railroad in operation thus:

"I arrived at Springfield from Jacksonville, by railroad, distance 36 miles. This road runs from Springfield to Meredosia, on the Illinois river; the whole distance is about 55 miles. They have a locomotive which leaves Springfield every other day, and Meredosia alternate days, Sundays excepted. They have a tolerable pleasant passenger car attached. The fare is $3,50 the whole distance; the trip occupies the greater part of the day, stopping both ways at Jacksonville to dine. This is the only *finished* railroad in the whole State, and it is in a miserable condition—so much so that no calculation can be made as to the time the cars will arrive; they generally say, "about such a time, if no accident occurs." The day I travelled on it, they ran off the track by means of one of the iron bars being loose and inclining in towards the centre of the track; not much damage was done. In some places the iron is torn off the rails, and remains off, and they have frequently to stop and get out to hold the end of the rail down while they run over it. The road is now in the hands of a company who have leased it for two years, for which they pay the State $10,000. Much prejudice exists against it. I could always read a paper or book while riding in a railroad car, but in this instance I had enough to do to keep my hat on. The people here, say this 55 miles of railroad has cost the State $11,000,000—that being the amount expended on this kind of improvement, while all have been abandoned but this one short piece."

Well, if this apology of a railroad has cost the State eleven millions of dollars, the people have only themselves to blame for it. When the subject of internal improvements came up in 1832, and strenuous efforts were made by some of her citizens to obtain means to construct a railroad, or canal

from the lake, at Chicago to the navigable waters of the Illinois, and thus open an easy and cheap communication through the State and make it a great thoroughfare of business and travel, the selfishness of the people would not consent to such a measure unless there could be—as in another State we could name—a grand system laid out to pervade the whole State, that all might enjoy equal privileges. In short, every man, or at least every member of the legislature, desired to have a city or a village on his own farm, that he might become wealthy at once; and hence, a large number of routes were projected, laid out, commenced, large amounts of money expended and then abandoned; and now complaints without number are heard from the very persons who caused, or did not prevent, such wastefulness, such folly. Illinois should have followed the example of New York in her early days of internal improvement. She should have constructed her *great* work through the State that other people might pay her tribute for passing and then have rested. A State can no more waste her means with propriety on visionary schemes than an individual, nor can she be justified in undertaking to construct works of doubtful utility merely to quiet a set of selfish individuals that they may not oppose works of vast public benefit.

---

RAILROADS IN INDIANA.

By the following paragraph from the Indiana State Journal, we learn that the company organized to complete the railroad from, as we suppose, Indianapolis to Lafayette is making some progress. This road was originally designed, we believe, to connect Michigan city with Indianapolis, and to be continued southwardly to Madison on the Mississippi river. We have had very little information of late in relation to the railroads and canals of Indiana. Will some friend of those works and of the Journal furnish us with an account of their present condition.

*The Railroad.*—By a letter from the president of the company, we learn that the cars have commenced running to Scipio, and that that place was to be the depot from last Monday week. In about five weeks the cars will run some 7 or 8 miles further north. The company, although not a year organized, have expended rising $80,000 on the road, and have nearly completed 17 miles; part of the grading of which, however, had been previously done by the State. We understand the company to be still going ahead, and in fine spirits.

---

The Troy Whig says the number of passengers carried over the Schenectady and Troy railroad during the week ending June 10th, was 1932; averaging 276 per day, Sunday inclusive.

HARTFORD AND NEW YORK.—The fare between Hartford and New York, by railroad, and also by the river, has been reduced to two dollars and fifty cents;—*fifty cents too high still.*

NEW RAILROAD PROJECT.—A correspondent of the Boston Daily Advertiser submits various statements to show the feasibility of building a railroad from Montreal, passing through Sherbrooke, L. C., Lancaster, the north of the White Mountains and Conway, to Great Falls N. H., connecting at the latter place with the railroads to Boston.

*To the Stockholders, Directors and Officers of Railroads—to Civil Engineers, Inventors of Railroad Machinery, Dealers in Railroad Materials and Mathematical Instruments—and to the Editorial Corps generally—*

The undersigned, proprietors of the American Railroad Journal, take this means of representing to those interested in the success of railroads and internal improvements generally, the advantages afforded by their work as an organ of communication with each other and the public, and also as an advertising medium—this being the only work devoted to the subject in the country—having been from its commencement favored by the communications of some of our most distinguished Civil Engineers and by the advertisements of several of the most successful manufacturers, inventors of improvements in railroad machinery, and dealers in railroad iron in all its forms.

Being desirous of bringing the work within the means of all who wish to avail themselves of its pages, they have obtained new type of smaller size, and thus are able to give three-fourths as much matter in *half* the number of pages, for two dollars a year; and as its circulation increases, we shall increase the quantity of reading, and *reduce* the price, hoping by this means to increase its usefulness, and give additional interest and value to the work. It is the only means by which advertisements in a single paper can reach those interested in railroads in widely distant parts of the Union, and it is designed to include *all* such persons among its subscribers.

TO DIRECTORS AND STOCKHOLDERS OF RAILROADS—

We need not say that the greatest ignorance has hitherto prevailed among people generally, in regard to the profit of railroads, and their character as an investment. It is true that, in many instances, where railroads have been constructed to benefit particular places or persons, without regard to other circumstances, the stock has not been found profitable, though even here in some cases, the value of property has been increased in amount equal to the entire cost of the road, but in almost every case, if not in *all*, where railroads have been *judiciously* located, *economically* constructed and *well managed*, they have proved good investments, and we do not hesitate to say that, within a few years, when those railroads now in course of construction, shall be completed, and others made to connect them with each other, and with canals and navigable waters, and further improvement of machinery now in rapid progress, shall be accomplished, railroad stocks will be found the safest, the most productive, and the favorite mode of investment. Even now, every mile of railroad completed, adds additional value to the thousands of miles already in use. Correct information only is required by the mass, in relation to the causes of failure, as well as to the true state of he case where works have been properly constructed, and are judiciously managed, to elevate the character of railroad stocks to the position they are designed to occupy. And how can such information be generally disseminated, you ask, to which we reply *circulate* the *Railroad Journal*

widely, and thus enable us to collect, digest, and arrange in tabular form the results of all the experience on the different roads in this country, and Europe, which will enable each company to adopt the improvements and avoid the errors of their neighbors, and to introduce economy and method in all their operations. As evidence of our desire to aid in the dissemination of correct and useful information, we propose to send to railroad companies and others interested, 25 copies of the Journal for one year, in one package, for $30; and to advertise one square on the cover for $8 a-year, and longer advertisements in proportion, thus giving the Journal and a yearly advertisement of a square for $10 a-year. Will you not, then, aid us in extending its circulation? and thereby promote the *general cause — your own and our interest?* We shall see.

TO CIVIL ENGINEERS.

The profession of Civil Engineers not having been organized into a society or institute, in this country, has as yet no official organ of communication with each other, or with the public generally. Meanwhile, the pages of the Railroad Journal have generally been resorted to for this purpose, and for a period of *several* years a good proportion of the professional papers which have been published have appeared therein. The circumstances of the times having made the necessity for such an organ greater than ever, it is respectfully urged upon Civil Engineers generally, to favor this work with articles of information, or discussion, on some of the important topics upon which it is desirable to obtain an exchange of opinion. When cuts or diagrams are necessary to illustrate their subjects, if not too costly they will be procured at the expense of the proprietors. As one, among many reasons for favoring this work, we may mention that the important subject of the employment of professional labor upon many legitimate objects other than railroads and canals, can be successfully advocated only in this Journal. It only remains for Civil Engineers themselves to decide whether a vast field of usefulness and profit to themselves and to others be opened or not.

TO MANUFACTURERS OF LOCOMOTIVES, STEAM ENGINES, RAILROAD MACHINERY AND MATHEMATICAL INSTRUMENTS,

This work affords a ready means of announcing their improvements to railroad companies, and also of advertising. It is well known that the newspapers of the day are seldom resorted to for advertisements of this class, and some mode of supplying this deficiency should be obtained. It is the intention of the proprietors of this Journal to make it the proper vehicle for all such notices—and we may confidently say that through its agency the reputation of our locomotives in Europe was first made known.

It is respectfully requested that manufacturers will communicate to us for publication, the peculiarities of their works, with a list of such engines as they may have constructed—particularly marine engines, with the dimensions and name, etc., of the steamers.

The performances of new engines, frequently, do not receive the credit they really deserve, because they are vaguely, and often incorrectly repre-

sented in the public journals. If such performances are well attested and presented for the consideration of those interested, it will certainly afford the best recommendation of their value, and the notice of the press generally can easily be obtained by means of the extensive exchanges of this Journal.

TO INVENTORS, PATENTEES AND DEALERS IN RAILROAD IRON AND MACHINERY,

We may hold out the same inducements. The want of success of many valuable improvements may be traced to the difficulty of obtaining access to persons interested and who are scattered over the whole United States. To all such, a ready communication with civil engineers and with railroad companies must prove highly useful.

TO THE GENTLEMEN OF THE PRESS.

We call upon the conductors of the Press throughout the country, who direct *public opinion*, that powerful machine, which only in this country, can carry forward important public improvements, to take a more active part in the collection and publication of local information in relation to works in their own vicinity, that we may be able to collate, condense and arrange the whole, and return it to them in convenient form for re-publication; and thus enable the people in every part of the country to know the extent, the character and the *benefits* of the system in the United States. And we respectfully ask them to copy more liberally from the Journal, and to call the attention of their readers to it, as a medium through which to obtain information in relation to the subject, and to send their paper in exchange.

GEORGE C. SCHAEFFER,
D. K. MINOR.

---

WOODEN PAVEMENTS.

We have always given our testimony in favor of this improvement. But it, like many other inventions, has had an undulating road to traverse in its ascent to permanent fame—at present it is on a descending grade, but gathering impetus to reach, by the aid of a good head of steam, and some stout pushing from it friends, a still higher level.

There are persons always ready to oppose everything, not of their own invention; but in spite of these, the improvement gained ground, until it was injured, as inventions sometimes are, as well as individuals—by their friends. This was done by the thousand and one patents which were taken out as soon as wood paving became somewhat the rage. We have from time to time noticed some of these; but a proper introduction to the whole, would be some dozen pages of solid geometry; and a suitable conclusion a disertation on the misplaced ingenuity of inventors. How many of these blocks were ever cut, is beyond our comprehension. In fact, we do not believe that a tithe of them ever was made; or if made, it would require a professor of mathematics to put them down. The contest between these various patentees, each abusing every plan but his own, had a tendency to throw all into disrepute.

The next difficulty was the question as to the durability of wood in this situation. Here the interests of rival patentees again led to erroneous opin-

ions as to the value of wooden paving, and various unfair, and even untrue statements of the decay under the different proportions were widely circulated; as far as our own observation extends, we are satisfied that much of the blame attached to this system of paving, belongs to the imperfect manner in which the work has been done, rather than to anything peculiar to the material or its form.

Recently the whole system has been decried on the occasion of the taking up of a pavement of this description in the upper part of Broadway, in this city. This was precisely what we predicted at the time, and had the intention been to throw into disrepute wooden pavements in general, no more effectual means could have been taken than were adopted in the construction of this specimen. In the first place, the blocks were not made true to the figure required, and the wood was unprepared. Secondly, the blocks were merely *laid* in their places without being either wedged or driven together; and to crown the folly, the blocks were not lifted by hand, but in the following novel manner: a smart blow was struck upon the upper surface by the edge of a sharp hatchet, if this penetrated to a sufficient depth, the block was raised sticking to the hatchet, and if not, the blow was repeated. By these means a series of indentations was made on the surface, and cracks caused throughout the block, which operated no doubt greatly to the preservation of the wood. Through the interstices between the pieces thus *openly* disposed, the wash of rain storms and the filthy water of the gutters found a ready channel until filled up by a mass of decomposing matter, operating as so much ferment to set the whole mass rotting. We doubt whether any *fungous pit* on the large scale was ever more ingeniously contrived.

The first trial of wooden blocks ever made on this side the Atlantic, was an advance, if we are not mistaken, of any similar pavements in England. Although without any preparation but a superficial coating of pitch after the pavement was laid, these blocks, though somewhat uneven, are yet, after the expiration of *eight* years, less unpleasant to pass over than the oft repaired ordinary stone pavement in its vicinity. We have before mentioned that this is in one of the greatest thoroughfares in the city.

Had these blocks been properly *Earleized* before they were put down, we have no hesitation in asserting that they would have remained up to this moment in perfect order. *Kyanizing*, if ever useful, is certainly out of the question in this case, by reason of its costliness.

If any more attempts at laying this kind of woodway are to be made, and we are satisfied that they will be made, let all proper care be taken in securing a good foundation—let a figure of the blocks be mathematically correct, (and this can be more readily and economically done by a simple machine contrived for the purpose, than by a single circular saw,) let them be *Earleized*, and lastly, let them be closely wedged together so that no interstices can be seen, then a coating of hot pitch poured over the whole and sprinkled with sand; and a pavement will be produced superior to any ever laid—nearly, if not quite as durable as ordinary stone paving, which requires frequent re-

pairs—as pliant and smooth as the finest turf, and we doubt not in the end as cheap as any other.

---

ACCOUNT OF THE SOUTH CAROLINA RAILROAD.

We extract from the last semi-annual report of this company, the following interesting account of their road. The history of this work contains a page from the history of the locomotive in the United States, or in fact in the world. It will be seen that the first engine built for this company, was constructed by Mr. E. L. Miller, now of this State. Mr. Miller was, at that time, a director, and on his return from a visit to England, where he had seen the best locomotives then built, he was so fully impressed with the vast capabilities of the locomotive engine that he urged the construction of one, and without any one to favor his views at first, he soon made converts to his side of the question. Mr. M. even had a small working model constructed at his own expense, in order to convince the citizens of Charleston that this was the best form of motive power for their road.

We are informed by this gentleman that this was not the first locomotive *built* in this country, but the first which ever was able to perform.

AN ACCOUNT OF THE ROAD.

In the fall term of 1827, Maj. Alexander Black on his own responsibility, at the suggestion of a friend, obtained the charter of the South Carolina canal and railroad company, and in doing this was permitted to address the senate to get the bill through that body, there being no one in the senate sufficiently acquainted with the subject, (he being a member of the house.)

This Charter was materially altered and amended at the extra session of January, 1828, making the capital $700,000, and to secure this Charter 3,500 shares of $100 each was required to be subscribed at the first opening of the books, (6 weeks after the passage of the act,) namely, on the 17th March, and to remain open until the 21st of the same month. On the 21st of March, 1828, at 9, P. M., the whole amount was made up, and ten dollars on each share paid, amounting to $35,000, all in Charleston, not a share taken at Hamburg, Columbia or Camden, where books were also opened.

| | |
|---|---|
| This amount of capital was all paid, | $350,000 |
| And the books were again opened for | 250,000 |
| And again in 1833, for | 300,000 |
| And again in 1835, for | 300,000 |
| And finally in 1837, for | 800,000 |
| In all | 2,000,000 |

And at each opening there was an over subscription by the original subscribers and their assignees, after the first subscription the books were never again opened to the public.

In the progress of the work, application was made to the legislature for $250,000, only $100,000 was granted, but this on liberal terms, 7 years, and interest at 5 per cent., payable at maturity of bonds. This has since been extended ten years more, to 1847, when the amount and interest will be due. The charter required that the road should be commenced within two years after the first subscription to the stock, and be completed for transportation within six years of that time. 1,000 tons of iron were imported immediately, and little more was done except making inquiry on the subject, and surveys on the line. Examinations of the country were made by Dr.

Howard, U. S. Engineer, and by Horatio Allen, Civil Engineer, who made the location; and on the 9th January, 1830, commenced the work at Line street, by driving piles of light wood, 8 by 8 inches square, 6½ feet apart along the line, and 6 feet apart laterally, caps or ties morticed on the piles 6 by 9, 9 feet long, and rails same size, notched on to these ties and wedged on the inner side. This construction was continued through nearly the whole line. When the work was over 15 feet high, three piles abreast were driven, and a sill placed on them near the ground, which supported a framed work, (an inverted W) on which the ties and rails were secured as before described.

This work costing $2,000 per mile including materials, except iron, on the level ground, and $2,500 to $4,000 per mile, over swamps 10 to 20 feet high. The excavation was done at 6 to 10 cents per yard generally.

In 1830, six miles only were finished; in 1831, nearly the whole road was put under contract; and in October, 1833, the road was connected from Line street to Hamburg, 136 miles.

| | | |
|---|---|---|
| The road cost for construction and materials, except iron, | | $584,542 43 |
| Iron and spikes, and putting down, | | 125,309 47 |
| | | $709 851 92 |
| Preliminary expenses and surveys, | $13,894 68 | |
| Engineer department, | 72,006 39 | |
| Work shops and materials, negroes, etc., | 43,892 11 | |
| Machinery, engines, cars and inclined plane, | 76,523 89 | |
| Land $13,950 82, road police $18,159 89, | 32,109 71 | |
| Office expenses to 1st Nov. 1829, | 2,869 69 | |
| | | 241,296 47 |
| | | $951,148 39 |

This road thus constructed with some alterations and improvements was kept up on *stilts* till 1836. Requiring then heavy repairs, and to be almost rebuilt, which was commenced that year by importing heavy flanged iron, now on the road, throwing up an embankment to support the piles and rails, and replacing timber where it was decayed.

This was continued through the years 1837, 1838, and completed in 1839 increasing the cost of the road and property of the company, in lands, buildings, negroes, machinery, materials, etc., as represented in the accounts, semi-annually reported by the secretary and treasurer, to $2,506,762 61, nearly $400,000 of this amount having been paid for from the income, rather than increase the capital to the cost of the road.

The grades on this road are very easy, not exceeding thirty feet in a mile, on the 120 miles to the inclined plane. That descends about 180 feet in half a mile, and beyond the plane a fall of 70 feet in two miles, or 35 feet per mile.

This inclined plane has been regarded a great mistake in the location of the road, as it might have been avoided by increasing the length of the road about six miles; but this would have made a continuous grade of thirty feet in a mile, where the trains would have been much retarded by frost, or when slightly wet, which is nearly bad as frost; and the cost of keeping up six miles of road on side hills, and having many curves, would have been more than the average of other parts of the road, and at the present reduced rates would probably exceed six hundred dollars per mile, or $3,600 for the six miles per year, which is very little less than the expense of the inclined plane; and passengers are passed over the latter with less delay than, (and without the expense,) on the six miles of road. The locomotive engine hav-

ing been substituted for the stationary, the expense is reduced about three thousand dollars per year, and is capable of performing more than has ever been required in a day, and almost daily making a trip to Hamburg, (16 miles,) besides doing the work of the plane. So the plane is not so objectionable as it was believed to be.

I would not be understood as recommending a steep inclined plane, requiring stationary or other extra power to overcome it, where it could be avoided at the maximum grade on other parts of the road. But having this plane, I would not recommend the abandonment of it at present, nor at any future time, unless a great increase of profitable business should render it more inconvenient than it now is, and warrant the cost of cutting round it.

HISTORY OF THE LOCOMOTIVE ENGINES.

Extract of a report by the Honorable Thomas Bennett, to the board, January 14th, 1830—five days after the building of the road was commenced.

"The locomotive shall alone be used. The perfection of this power in its application to railroads is fast maturing, and will certainly reach, within the period of constructing our road, a degree of excellence which will render the application of animal power, a gross abuse of the gifts of genius and science."

This was assuming a great deal, when animal power was used years after this, on all the other railroads then constructing in this country. But what then were our expectations as regarded the performance of a locomotive?—On the 1st of March, 1830, a committee reported that they had accepted the offer of Mr. E. L. Miller, to construct a locomotive engine in New York, at the West Point Foundry; and that she should perform at the rate of ten miles an hour, instead of eight as first proposed, and carry three times her weight, which was required the year before on the Liverpool and Manchester road, at the trial of engines for the premium of £500, which Mr. Miller went out to witness. Mr. Miller's engine, under the above contract, was brought out by him in the fall of that year, (1830) and on the 14th and 15th of December, had her trial, and proved her power and efficiency double that contracted for—running at the rate of 16 to 21 miles an hour, with 40 to 50 passengers in some four or five cars, and without the cars, 30 to 35 miles an hour.

This engine continued to carry passengers up and down the line until the road was finished; at one time going 72 miles out and back the same day—and carrying at one time 100 passengers. After the road was completed, this engine conveyed the passengers between Aiken and Hamburg for years, and probably ran as many miles as any engine ever built, and performed equal to any of her size, (about four tons weight.)

This was the first locomotive engine, we believe, built in the U. States, to run on a railroad—she was at first called the "Best Friend," but having her boiler burst in June, 1831, and renewed in Charleston—she was afterwards called the "Phœnix."

From 1836 to 1843, 4 engines only were ordered; 2 in 1837, and 2 in 1839; all from Philadelphia. 7 others were received in 1837 and 1838, of the 35 ordered above.

In the last two years, four engines have been built in the work-shops of the company, besides rebuilding several of those previously purchased.

The whole number, in the list annexed, (marked 8) is 44, purchased and built by the company, and are accounted for as follows:

19 broken up, (except 2 boilers rebuilt.)

1 sold to the St. Joseph's railroad company, and 24 in the present schedule.

Of these, 6 were made in Philadelphia, 10 in Charleston, and 7 in Eng-

land—including 1 of the Philadelphia, 2 of the English, and 2 of the Charleston, rebuilding, or to be rebuilt.

Preparations are making for two more engines like the Orangeburg, the first of our make; which performs so well—parts are cast and fitting, and will no doubt be finished for another season's business.

It will be seen by the foregoing statement, that four engines only have been ordered in the last six years, and none in the last three years. Yet the power has been kept up by building and rebuilding much more efficiently, than when six or seven were ordered annually.

THE PECULIARITIES OF THIS ROAD, ETC.

The construction of this road on piles is becoming more in favor with others, as well as those having the advantage of it. Several roads at the north are partially on this plan. The New York and Erie railroad to be 446 miles long, is to be about one-half, built in this way. Over 70 miles of piles have been already driven.

It saves much of the cost of embanking a road by being able to transport the earth upon it to fill the valleys and swamps, and before it is necessary to do this, the income of the road is providing for the payment while it is constructing.

It preserves the line and level of the road after the embankment is made; when roads are built on fills and cuts without piles, the superstructure is continually liable to be disturbed by the sinking of the banks, or water settling in the excavations, much to the injury of passing trains, frequently breaking axles, and otherwise deranging the machinery of the engines.

The large wooden water-courses through the road are much more safe, and give less trouble than those made of brick or stone, unless very large, and foundations well secured, which has been difficult to attain in some of the late constructed works. The cost of the wooden-culvert is less than the interest of the cost of those built in masonry, and they can be kept in repair for one-fifth their first cost annually.

The flanged iron, now on the whole of the main track, weighing about forty tons to the mile, gives no trouble; a less number of bars have failed since first commenced putting it down in 1836 than have been condemned in the first year of the best edge-rail on other roads, although the latter are decidedly preferable where timber for rails cannot be readily and cheaply obtained.

The frequent turn-outs every four or five miles, answer nearly all the purpose of a double track, while the first cost and expense of repairs of a second is saved.

The lateral sections for supplying *wood* to the tenders, keeps it off from the road, lessening the risk of fire and gives despatch in receiving it.

The contracting for the wood cut and hauled in lengths to feed the engine, avoids much trash that would be caused by the chips and bark that would be collected if cut at the station.

And by having the wood corded or piled for measurement by the *station man*, he is made responsible for the quantity and quality in each cord.

The barrel cars, found only on this road, contribute largely to the economy of transportation; these, both for passengers or freight, cost about half the expense of the square car of the same capacity, are much more durable, and require less repairs, and if thrown from the road are not so liable to be broken.

This was lately tested, by the rolling off of one down a hill, several rods, loaded with cotton, without starting a joint. In putting it on the road, however, by the carelessness of the workmen who did it, several staves were

broken; advantage was taken of this by proving how readily and cheaply it could be repaired. The broken staves were replaced with new ones at a trifling expense. When a similar accident happens to the old formed cars they are generally so much broken as to be unworthy of repair.

The new arrangement of the interior of one of the barrel cars looks awkward, and is frequently condemned by strangers at first sight, and some are resolved not to be reconciled to it. The warm weather will show the advantage of this plan when the windows are required to be open—the passenger is kept more out of the dust, fire and sun, than by any other arrangement of the seats. The cushions are more easily kept clean, and being in the centre, are warmer in the winter and cooler in the summer. The seats, back to back, give more room under them for small baggage, and the rails and shelf over the backs are for light articles, such as too frequently occupy half the seats in the other cars.

---

VISIT TO MR. BURDEN'S IRON WORKS, TROY.

We find the annexed account of a visit to the Iron Works of Mr. H. Burden, near Troy, in the New York American, of 24th May—from the pen of its able and observing editor, Mr. Charles King. A recent visit by one of the editors of this Journal enables us to add a few additional particulars to his vivid account, which may possibly aid in a clear understanding of this establishment.

The fall of water, within 35 rods, is about 53 feet, which enabled the ingenious proprietor to exercise his mechanical skill to some purpose. His supply of water, on the ordinary sized wheel, would not carry the half of his present machinery—which, by the bye, is but a small portion of his ultimate aim—and, therefore he has constructed a wheel of 51 feet diameter, with 21 feet length, and 8 feet depth of bucket; in which 70 to 80 tons of water may be contained without overflowing—thus giving him the control of power in reserve, very far beyond, perhaps *double* his requirements, when all his present machinery, employing over 250 persons, all told, is in full operation.

This wheel is indeed a curiosity. Its equal has not, that we can learn, yet been constructed. With the exception of the buckets, it is entirely of iron. The shaft is of wrought iron, and in two parts, being about 16 inches diameter at the journal ends, and 10 inches where it comes together, within a collar, at the centre. Upon this shaft are four cast iron rims of about 4 feet diameter, with flanges so constructed as to receive the *arms* of the wheel which are wrought iron rods, $1\frac{1}{4}$ inch diameter, 23 feet long, and about 500 in number, passing through the flanges on the shaft, and made fast by two nuts. To the outer ends of these rods the periphery, or bed of the buckets, of 6 inch pine timber is made fast with nuts, by which this immense mass of material can be adjusted to an accuracy of movement truly astonishing, and it is so perfectly balanced that it is scarcely heard; and so tight and well preserved that the inside of the wheel is kept dry, not a drop of water nor a wet spot could be seen on the inner surface.

The pit for this immense wheel is excavated from a slate rock to the depth of 25 feet, and from the deepest part of it a tunnel is excavated through the

same rock into the natural bed of the stream below, for the discharge of the water. The average revolution of the wheel is about 14 per minute, or 105 revolutions per hour. There is a rack on each end of the buckets working into pinions 22 inches diameter, on different lines of shafting hundreds of feet in length, one of which operates a large number of nail machines, another a long line of spike machines and the famous horseshoe machines, and a third moves the immense balance wheel of 20 tons, and the ponderous machinery for making iron from the pig into all sorts and sizes; and blows the bellows for the puddling and other furnaces.

There are three great curiosities in this establishment even to those who are familiar with the process of making iron into its various forms, and then into nails and spikes—the wheel, the "iron whirligig" and the horseshoe machine. The like are not to be found elsewhere in this country.

Mr. Burden estimates that his wheel is competent to drive machinery sufficient to employ over a *thousand* persons, men and boys, as they are usually employed in similar establishments, though he has not now over one-fourth that number employed, but we hope eventually to see it tasked to its utmost ability, and that the ingenious and enterprising proprietor may reap a rich reward for his years of persevering industry.

"Taking advantage of a flying trip," says the editor of the N. Y. American, "to Troy and of the civil invitation of Mr. Burden to visit his works, we spent an hour or two most agreeably among fire balls, fire bars and fire serpents of iron—all manipulated by men, and by machinery, like so many pretty and innocent play things.

"The works are situated in a wild ravine, worn out of a slate rock by a short and rapid natural stream called Wynant's kill, we think Mr. Burden said. This stream supplies the whole power of the machinery here employed, and the wheel which imparts motion to the machines of the respective work shops is in itself one of the grandest objects of the sort we ever saw.

"It is an immense wheel of 51 feet in diameter, as high as a three story house, and 22 feet wide, over which, into troughs hollowed out for its reception, falls a sheet of water so thin that but for the evidence of the senses, one would hardly believe an agent so comparatively feeble, could cause the ponderous wheel to turn with a momentum, that puts in play hundreds of other wheels and machines of different sorts.

"The channel way in which this immense water wheel turns, is cut out of the solid rock. The axle is of wrought iron, and from the flanges project hundreds of iron rods, that support the periphery of the wheel, and steady and strengthen the whole structure. In its grand, deliberate and majestic revolution, there is really much of the sublime; and when it is perceived, that from this single and simple power, vast combinations of machinery derive their motion, the feeling of admiration is yet farther excited.

"The destruction of confidence, the absence of a national currency, and the other effects of misgovernment which have cursed the whole country, ever since the political malignity of Secretary Woodbury, aided by the political popularity and the unscrupulous will of Andrew Jackson, commenced a war upon the national currency—have of course been felt in these extensive works, and but few persons, comparatively, and portions only of the shops, were employed. Nevertheless, the various processes of puddling the iron,

of placing the misshapen glowing mass in a sort of iron whirligig, (a recent invention, by the bye, of Mr. Burden, the patent for which, for England, he has sold at a round sum,) which, by its rapid evolution, casts off all the *scoria* while, by pressure, it forms the mass into a square block, of drawing this block over and under successive rollers into long, flat iron bars; the rolling out, by like means, of the flexible, red hot iron rods, that coil their bright folds alarmingly around the spectator, like so many living and literally, as now and then they come in contact with water, hissing serpents; this, and much more, we witnessed with great satisfaction, though not without a certain sense of bewilderment at the astonishing regularity with which everything proceeded amid a din and what seemed confusion unspeakable. A son of Mr. Burden, an intelligent young man, and a thorough workie, like his father, is superintendent of this department.

"Thence we proceeded to other shops. In the first was a row of lads sitting before sharp biting machines, within whose maw they continually thrust thin blades of cold iron, and which these reasoning and calculating machines convert as rapidly as thought, into nails pointed, headed and squared, ready for use.

"In another, a spike shop, this process was repeated on a larger scale; for there, thick square rods of red-hot iron were thrust into the machines, which by one simultaneous action, cut them off in the requisite length for spikes, headed and pointed them, and dropped them out below.

"No other human agency is requisite to either of these machines than simply to furnish the raw iron, and remove the finished fabric; the intelligent mechanism does all the rest.

"The most curions of all, however, is the more recent invention of Mr. Burden for making horse shoes. Two machines are required for this work, and a boy to assist the process. In the first, the iron in thin bars is put in, grooved and pierced with holes for the nails; in the next, it is flattened by pressure, and then rounded to the precise form of the hoop. Shoes of all sizes are thus made, and with unerring accuracy. Moreover, as the nail-holes are all punched upon an accurate calculation of the average thickness of the horny part of the hoof in which the nails are driven, there can be no possibility, even with a drunken or ignorant blacksmith, of pricking the horse, because the nail can only take the direction indicated by the hole. This is, in itself, a decided superiority in these shoes; for every one who has kept horses, knows how liable the noble animal is to suffering and lameness, from the holes of the shoe, punched by an unskillful blacksmith, being too far within the rim, and consequently conducting the nail into, or close upon the quick, instead of into the horn.

"Another advantage is in the great toughness of the iron thus fashioned by machinery; for none but the toughest would bear the strain.

"The price at which Mr. Burden can sell these shoes is greatly below that at present paid, and we hope soon to see them in general use.

"From these lower regions of Mr. Burden's dominions, we ascended to the upper air of his fine residence, on the hill, surrounded with beautiful trees and shrubbery, superb gardens, and commanding a view up and down and across the Hudson, of great beauty.

"Here, after the day's work, Mr. Burden is as retired from his factories, though lying directly beneath him, as if miles away; and we confess the satisfaction with which we witnessed the taste and comfort that surrounded the dwelling of this self-made mechanic.

### MILK AND RAILROADS.

A queer juxtaposition—but no fiction for all that. The time was when some wag proposed the introduction of milk into our large cities by means of an open canal, but the age of canals has in a measure passed away The next suggestion was, that of a covered aqueduct and the final distribution by pipes. This was too costly a plan and the pipes would have interfered with those for the distribution of Croton water in New York at least. But this is the "iron age" of railroads, and they have successfully accomplished and daily perform the task of the introduction of pure and wholesome milk into our city.

We suppose that the character of suburban milk is pretty well known, at least in New York. Water is the chief ingredient—starch, magnesia, and similar substances are added to give what the painters call body. The milk from the cow, which enters in a small proportion into the compound, is perhaps not quite so bad as it is usually represented, though we must confess that the cows are fed on most villanous stuff, which would be rather out of place even in the hog trough. We remember some curious details of the milk trade related by a worthy clergyman of our acquaintance, who happened to fall in with a milkman while at the pump. The fellow being of a frank disposition, cheerfully communicated many interesting particulars of a "professional" character. Among others, he stated that unless a certain quantity of water were added, he could find no purchasers for his milk, as from its color and consistency he would be suspected of adding the refuse of the starch factories!

We put these things on record for the benefit of future antiquarians—they already belong to the history of the past. At this moment pure and wholesome milk is sold all over the city at four cents per quart—the price for the composition above named was six, undoubtedly owing to the cost of the materials. This wonderful revolution has been wrought through the agency of the New York and Erie railroad—and affords a fine example of the benefits of railroads. This may be thought by some a small matter, but it is far otherwise, for, sometime since, we were informed that, if the milk business were to continue as it had commenced, it would be found necessary and profitable to run for its accommodation a special train.

The following is the mode in which the transportation is performed, as related by a resident of Orange county, in the Cultivator:

"The cows are milked early in the morning at Goshen and its vicinity, the milk put into cans containing from 60 to 75 quarts, into which a tin tube filled with ice is inserted, and stirred until the animal heat is expelled from the milk. It is then sent by the railroad, and arrives, a distance of 80 miles at the milk depots (which are numerous in the city,) in four and a-half hours. The tube filled with ice is again inserted, and the milk thus kept cool and sweet until sold. It can be afforded to the public at four cents per quart, of which the farmer gets two cents per quart and is well satisfied, as it yields more than butter at twenty-five cents per pound."

Here we find that three parties are benefited. The farmer makes a pro-

fitable disposition of his milk—the railroad company receives a handsome freight and the public a pure and at the same time cheap article. Not only so, but this milk is sold in the city of Brooklyn, the very head quarters of the milk factories and with the whole of Long Island "the garden of New York" at its back.

After this, who can say that railways are not destined to add to the comforts and luxuries as well as to the necessities of life—or who can say that the city of New York has yet began to realize the benefits it will derive from being, at *some* distant day, the centre of a web of "judiciously located and well constructed" railways.

---

CHEAP TRAVELLING.—Those splendid steamers, the Troy and Empire, now carry passengers from Troy to New York for 25 cents, and sometimes for 12½ cents. No one can find any fault with this price but the proprietors. So much for "chartered monopolies."

We take the above paragraph from the Troy Whig, and regret that it had not been accompanied with a word of disapproval by the editor of that excellent paper. This competition, ruinous as it must be to the proprietors, is also injurious to the community. It leads people *from home*, because it is, the say, cheaper to go than to remain, and many into other expenses which they cannot afford. The prices for passage should be fixed at reasonable rates to those who must travel, but at the same time at rates which will compensate liberally those who invest their capital in such boats, and provide such accommodations and excellent officers as are found in the above named boats and in the boats of the Peoples' line on the Hudson. We refer, not invidiously to, but because we have known them personally for years and can say confidently that more competent and careful men cannot be found in the business, than in the commanders of the boats referred to.

---

WESTERN RAILROAD.—Receipts for one week, June 3d,

| | |
|---|---|
| 1843, - - - - - - - - - - | $12,008 |
| 1842, - - - - - - - - - - | 9,972 |
| Increase, - - - - - - - - - | 2,036 |

Total increase in May, $10,105, being over 25 per cent.

The result, in part, of the adoption of the system of "low fares." One unacquainted with the operations of a *business* railroad, i. e. on which all kinds of *freighting* is done, will hardly believe the assertion that a drove of 1500 live hogs were carried over the Western railroad a few days ago, in 16 cars in one train, and 50 head of cattle were also to go in the same train. As many as 3000 hogs have been taken over that road, in one train, we were told, when at the Greenbush depot for a few minutes, a short time since, and at an expense of course little greater than their feed would have cost while travelling to Boston. Thus it is that *Boston* steps in between New York and the western business, and says "after us, gentlemen, you can *help yourselves* if you will;" may we ask when, *when will* the citizens of New York see and feel the necessity of helping themselves?

NATIONAL INSTITUTE.

At a late meeting of the institute, Capt. Geo. W. Hughes, of the topographical engineers, made the following remarks on the subject of the stone of which the great Plymouth breakwater is constructed, specimens of which have been presented to the institute by T. W. Fox, consul of the United States at Plymouth:

"In listening to the reading of the record of the proceedings of last meeting, one item especially arrested my attention, in relation to which I beg leave to offer a few observations. I refer to the letter of Mr. Fox, of Plymouth, in which, after expressing a deep interest in the success of the National Institute, he informs the corresponding secretary that he has shipped for our cabinet a large specimen of the stone used in the construction of the breakwater at Plymouth—one of those stupendous works, combining the useful with the grand, for which his government is so justly celebrated, and which may be said to mark the difference between the utilitarian structures of modern times and the gigantic but useless and unmeaning works of remote antiquity. The dimensions of the breakwater are as follows: Breadth at base, 410 feet; ditto at top, 95 feet; breadth of front sea-slope, 85 feet; ditto inner or land-slope, 110 feet; average breadth of fore-shore, 65 feet; breadth of outer sea-slope, 108 feet; length at the base, 1800 yards; ditto on the top, 1700 yards; average height 42 feet. It is nearly finished, and when completed will contain about 3,500,000 tons of stone, at a cost of nearly £1,500,000, including the accessary works.

"All the rock employed in the structure, with the exception of about 100,000 tons of *cut* granite, is a *limestone* (abounding in *madrepores*) from the Oreston quarries on the cutwater near Plymouth. The weight of a cube foot of this stone is 168 lbs. or 13⅓ cube feet to the ton. When the late Mr. Rennie undertook this work he considered it as a matter for congratulation that so *enduring* a material as the Oreston limestone could be procured with so much facility; but subsequent experience has shown that that eminent engineer was in great error in reference to its durability in salt water, owing to the ravages to which it is exposed from the attacks of a small *shell-fish*, which perforates it in all directions, and gives to the stone a *honey-comb* appearance, not unlike that of wood bored by the carpenter bee or by the sea worm. This enemy of the limestone is called the *saxicava rugosa* of Lamarck, or *mytilus rugosa* of Linnæus. It belongs to the genera Lithophaga, section C, Termipeda, first order of the 11th class, conchifera, of Lamarck, who thus describes it: "*Lithopaga*, third genus; boring shells, without accessory pieces or sheaths, and more or less gaping at their anterior side; ligament of the valves external. *Saxicava:* shell bivalve, transverse, inequilateral, gaping anteriorly at the superior margin; hinge almost without teeth; ligament external. The *petricola* pholadeformis belongs to the same genera." The saxicava generally attach themselves to the blocks of stone between the bottom and the line of low water; but they are sometimes found above that level. They penetrate the stone to the depth of five or six inches, and when this portion becomes abraded by the action of the waves, they bore still deeper into the rock. By this process, this immense work is slowly but certainly crumbling to decay; and it is stated, on semi-official authority, 'that hundreds of tons are destroyed by it (the saxicava) in every year.' They adhere to the limestone in thousands, at first not longer than a pea, but, as they bury themselves in the rock, increase in size till they attain half an inch in diameter. It seems doubtful if they feed on the material of the rock, as they put out their feelers from the holes to catch such food as may be floating by.

"The quay works of the dock-yard at Devonport, built of Portland stone, has also suffered from the ravages of this animal.

"It is not to the loose stones alone that the saxicava adhere, for they likewise attach themselves to the native rock below the surface of the water; and it is said, 'that their operations have been so extensive as to deepen the water in some places several feet. I have, in walking along the beech of Plymouth sound, picked up stones which had been perforated and detached by the active agency of these persevering conchifera.

"The *modus operandi* by which these animals bore into the solid rock has been the subject of much discussion. That it is not by eating or gnawing into it is rendered pretty certain by their soft bodies and fragile shells. Dr. Buckland supposed that the holes were produced by the action of an acid secreted by the animal; but to this theory it may be objected that no acid has been found it it, and that if there were it would be as likely to act on its own shell as on the limestone. To this latter objection it might be replied that, perhaps, the *vital principal* would resist this action. Professor Sedgewick suggested that the animal probably effected its lodgment by the rapid agitation of water in small vortices. We know that rocks in running waters are frequently pierced by a similar agency.

"I have recently seen, in the cabinet of Mr. Bruff, of this city, a fragment of a limestone rock from the vicinity of Gibralter perforated by the action of a shell-fish, the shells of which are contained in the cavities. But the saxicava must not be confounded with the *date fish*, so called from its resemblance to that fruit, found in the limestone mud of the Mediterranean, which becomes on exposure sufficiently indurated to form a good building material.

"It may be of some consequence, Mr. President, that these facts should be known, especially to the architect and engineer, and this must be my apology for trespassing so long on the time of the meeting. It would appear, from the statements, that the only materials which can be used with absolute safety in submarine structures are granite, greenstone, basalt, or some other stone which has been previously fused."

---

### NEW METHOD OF SENDING PORK TO MARKET.

We find in the Troy Whig the following novel description of sending *pork* to market. It is certainly an improvement, in point of economy, and still it will be vastly improved upon when the New York, and Erie and other railroads shall be completed to the great pork region of our country. We shall then see *cars* constructed for that purpose and filled with the produce of the west *in bulk*, and brought to our market during the cold seasons, and thus not only save a vast expense in packages, but also give our citizens not only the benefit of *winter employment*, but also of constant new supplies, and of course regular prices, during the winter—advantages to our citizens which alone would be worth, in seven years the cost of a railroad from New York to Cincinnati.

"We saw yesterday at one of our docks a canal boat loaded with pork *in bulk*, shipped by W. Martin & Co., of Circleville, Ohio, by the Troy and Erie line. This pork is cut up in the following manner. After taking off the head and hams, the remainder of the hog is cut into four pieces, which are first washed with a solution of saltpetre, and then sprinkled with salt. With no other preparation than this, they are shipped in bulk from Circleville to New York, where they will be packed and re-salted in the usual manner.

The lot of pork to which we refer, contained 55 tons, and looked as well as any pork we ever saw. By this new method of cutting it up, a great saving is effected in the cost of transportation; the quality of the pork being preserved equally well as when barrelled. This shipment will doubtless be followed by others of a similar nature."

### TROY AND SCHENECTADY RAILROAD.

We passed over this road a few days since, and found it uncommonly easy to ride upon. On leaving the *Troy House* after an excellent breakfast, we entered the car, which seems to have been constructed with a view to cleanliness and comfort, being sustained by the "atmospheric springs," and well ventilated. We were taken by horse power over the Hudson, to the depot, and in a few minutes were attached to a locomotive and under way, at a rapid rate, notwithstanding the ascent, after passing a short distance, was at the rate of 52 feet to the mile for several miles. The route from Troy to Schenectady, by the railroad is delightful; well cultivated fields, the canal with its numerous boats passing in each direction; the Hudson stretching far to the north; the Mohawk with its beautiful *Cohoes*, its winding among the hills and its aqueduct for the passage of the canal; and the far off green hills which are beheld constantly presenting new and beautiful views, will render this road from New York to the west a favorite route. It will at least come in for its share of the travel when it is better known. From the little opportunity we had to examine the work, we were led to believe that it is well built, well found and *well managed* and therefore *deserves* to be well patronized.

### DIVIDENDS ON RAILROAD STOCKS.

"The Boston and Worcester railroad company have declared a dividend of 3 per cent. for the last six months."

We desire hereafter to give an account of all declared dividends upon railroad stocks in the United States, and therefore will thank the officers of the different railroad companies to furnish us with official statements whenever dividends are declared, that we may be able to show the present and prospective value of such investments, which we believe will be found among the most profitable and the safest in the country.

"Please exchange" with the Railroad Journal, and if you will do us the favor to say that "the number for July is received, and may be examined at our office;" and that "subscriptions will be received, and the money forwarded;" and if you will even go so far as to copy the list of contents, you will greatly oblige the Editors, and aid the cause.

## CONTENTS:


| | Page. | | Page. |
|---|---|---|---|
| Deterioration of wrought iron axles, | 193 | To Civil engineers, | 210 |
| Changes induced in the structure of iron, | 194 | Wooden pavements, | 211 |
| Professional employment, | 199 | Account of the South Carolina railroad, | 213 |
| Practical remarks on blast furnaces, | 200 | Visit to Mr. Burden's iron works, Troy, | 217 |
| Railroad notices, | 204 | Milk and railroads, | 220 |
| Hartford and Springfield railroad, | 205 | Cheap travelling, | 221 |
| Low fares on railways, | 205 | Western railroad receipts, | 221 |
| Railroads in Illinois, | 207 | National Institute, | 222 |
| Railroads in Indiana, | 208 | New method of sending pork to market, | 223 |
| Circular, | 209 | Troy and Schenectady railroad.—Dividends, | 224 |